

1038.5.1

(based closely on ISO 1928 - 1976)

Under Revision see DR 95274

AS 1038.5.1—1988

~~REFERENCE COPY~~

WITHDRAWN:

19980605

~~INFORMATION CENTRE
STANDARDS AUSTRALIA~~

SUPERSEDED BY:

AS 1038.5-1998

Standards

Association of

Australia



Australian Standard®

1038.5.1—1988

**METHODS FOR THE ANALYSIS AND
TESTING OF COAL AND COKE**

**Part 5.1—GROSS SPECIFIC
ENERGY OF COAL AND
COKE—ADIABATIC
CALORIMETERS**



This Australian Standard was prepared by Committee MN/1, Coal and Coke. It was approved on behalf of the Council of the Standards Association of Australia on 6 April 1988 and published on 17 June 1988.

The following interests are represented on Committee MN/1:

Australasian Institute of Mining and Metallurgy
Australian Coal Association
Australian Coal Industry Research Laboratories
Australian Institute of Energy
Bureau of Steel Manufacturers of Australia
Coal Preparation Society of N.S.W.
Coal Preparation Society of Queensland
Confederation of Australian Industry
CSIRO, Division of Coal Technology
Department of Mineral Resources, N.S.W.
Department of Mines, Queensland
Department of Primary Industries and Energy
Electricity Supply Association of Australia
Institution of Engineers, Australia
Joint Coal Board
National Association of Testing Authorities, Australia
Queensland Coal Board
Royal Australian Chemical Institute
Standing Committee on Coalfield Geology of New South Wales
State Chemical Laboratory, Vic.
University of New South Wales
University of Queensland

Review of Australian Standards. To keep abreast of progress in industry, Australian Standards are subject to periodic review and are kept up-to-date by the issue of amendments or new editions as necessary. It is important therefore that Standards users ensure that they are in possession of the latest edition, and any amendments thereto.

Full details of all SAA publications will be found in the Catalogue of SAA Publications; this information is supplemented each month by SAA's journal 'The Australian Standard', which subscribing members receive, and which gives details of new publications, new editions and amendments, and of withdrawn Standards.

Suggestions for improvements to Australian Standards, addressed to the head office of the Association, are welcomed. Notification of any inaccuracy or ambiguity found in an Australian Standard should be made without delay in order that the matter may be investigated and appropriate action taken.

AUSTRALIAN STANDARD

**METHODS FOR THE ANALYSIS AND
TESTING OF COAL AND COKE**

Part 5.1

**GROSS SPECIFIC ENERGY OF
COAL AND COKE—ADIABATIC
CALORIMETERS**

AS 1038.5.1—1988

First published as part of CK2 Part III—1949.
Revised and redesignated K152.5—1965
(endorsement of BS 1016.5—1957 with amendment).
Second edition 1969. *Endorsement of BS 1016.5—1967 with amendment no. 1*
Revised and redesignated AS 1038.5—1979.
Revised and redesignated in part AS 1038.5.1—1988.

PUBLISHED BY THE STANDARDS ASSOCIATION OF AUSTRALIA
STANDARDS HOUSE, 80 ARTHUR ST, NORTH SYDNEY, N.S.W.

ISBN 0 7262 5110 0

PREFACE

This Standard was prepared by the Association's Subcommittee on Coal Evaluation under the supervision of the Committee on Coal and Coke and the direction of the Minerals Standards Board, to supersede AS 1038.5—1979, *Methods for the analysis and testing of coal and coke, Part 5: Gross specific energy of coal and coke*.

Major alterations to the previous edition are as follows:

- (a) AS 1038.5 has now been split as follows:
 - Part 5.1: *Gross specific energy of coal and coke—Adiabatic calorimeters*
 - Part 5.2: *Gross specific energy of coal and coke—Isothermal-type calorimeters*.
- (b) Changes have been made to the procedure for the preparation of the barium hydroxide solution and the consequent change to the correction for the heat of formation of acids.
- (c) Part 5.2 includes the use of waterless calorimeter systems.
- (d) Part 5.2 includes calorimeter systems which employ automatic temperature monitoring and data computation.

The method is based closely on ISO 1928, *Solid mineral fuels—Determination of gross calorific value by the calorimeter bomb method, and calculation of net calorific value*. It differs from ISO 1928 in that it does not include the calculation of the net specific energy of the coal, which is described in AS 1038.16.

CONTENTS

	<i>Page</i>
1 SCOPE	3
2 REFERENCED DOCUMENTS	3
3 DEFINITIONS	3
4 PRINCIPLE	3
5 SAFETY	3
6 REAGENTS	3
7 APPARATUS	4
8 SAMPLE	5
9 PROCEDURE	6
10 CORRECTIONS	7
11 CALCULATIONS AND EXPRESSION OF RESULTS	7
12 PRECISION OF THE DETERMINATION	8
13 TEST REPORT	8

APPENDICES

A DETERMINATION OF MEAN EFFECTIVE HEAT CAPACITY OF THE CALORIMETER (C_m) AND 'PREDETERMINED INTERVAL'	9
B EXAMPLES TO ILLUSTRATE METHOD OF CALCULATING RESULTS	11

© Copyright — STANDARDS ASSOCIATION OF AUSTRALIA 1988

Users of Standards are reminded that copyright subsists in all SAA publications. Except where the Copyright Act otherwise allows, no part of this publication may be reproduced, stored in a retrieval system in any form or transmitted by any means without prior permission in writing of the Standards Association of Australia. Requests for permission should be directed to the Head Office of the Association. Where such requests relate to the reproduction of the whole or a substantial part of any Standard, permission may be conditional on an appropriate royalty payment.

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

METHODS FOR THE ANALYSIS AND TESTING OF COAL AND COKE

PART 5.1: GROSS SPECIFIC ENERGY OF COAL AND COKE—
ADIABATIC CALORIMETERS

1 SCOPE. This Standard sets out a method for the determination of the gross specific energy of coal or coke, at constant volume, using a bomb calorimeter with an adiabatic water jacket.

2 REFERENCED DOCUMENTS. The following Standards are referred to in this Standard:

AS

- 1038 Methods for the analysis and testing of coal and coke
 Part 3: Proximate analysis of hard coal (AS 1038.3)
 Part 4: Proximate analysis of coke (AS 1038.4)
 Part 6.1: Ultimate analysis of higher rank coal—Determination of carbon and hydrogen (AS 1038.6.1)
 Part 6.3: Ultimate analysis of higher rank coal—Determination of total sulphur (AS 1038.6.3)
 Part 7: Ultimate analysis of coke (AS 1038.7)
 Part 16: Acceptance and reporting of results (AS 1038.16)

1152 Test sieves

1210 Unfired pressure vessels

1349 Bourdon tube pressure and vacuum gauges

2243 Safety in laboratories

2418 Glossary of terms relating to solid mineral fuels

2646 Sampling of solid mineral fuels

Part 6: Hard coal—Preparation of samples (AS 2646.6)

Part 7: Coke—Preparation of samples (AS 2646.7)

2706 Numerical values—Rounding and interpretation of limiting values

BS

791 Specification for solid-stem calorimeter thermometers

4791 Specification for calorimeter bombs

3 DEFINITIONS. For the purpose of this Standard, the definitions given in AS 2418, and those below, apply.

3.1 Gross specific energy at constant volume—the number of heat units liberated when unit mass of solid fuel is burned in oxygen in a bomb under standard conditions. The materials after combustion are taken to consist of the gases oxygen, carbon dioxide, sulphur dioxide, nitrogen and oxides of nitrogen, liquid water (in equilibrium with its vapour and saturated with carbon dioxide) and solid ash.

3.2 Effective heat capacity of the system—the heat required to cause unit rise of temperature in the calorimeter system under the conditions of a calorimetric determination.

3.3 Repeatability (r)—the value at or below which the absolute difference between two single test results obtained with the same method on identical test material, under the same conditions (same operator, same apparatus, same laboratory, and the minimum practical time difference consistent with separate tests), may be expected to lie with a specified probability. In the absence of other specifications, the probability is 95 percent.

3.4 Reproducibility (R)—the value at or below which the absolute difference between two single test results obtained by operators in different laboratories may be expected to lie with a specified probability. In the absence of other specifications, the probability is 95 percent.

4 PRINCIPLE. A known mass of the sample is burned in oxygen in a bomb calorimeter under standard conditions. The gross specific energy is calculated from the rise in temperature of the water in the calorimeter vessel and the mean effective heat capacity of the system. Allowances are made for the heat released by the ignition fuse material for thermochemical corrections.

The international reference temperature for thermochemistry of 25°C is used as the reference temperature for specific energy, although the temperature dependence of the specific energy of coal or coke is small (about 1 J/g.K).

Full discussion of the principles involved in the determination of specific energy, the theoretical derivation of the corrections that have to be applied and the importance of the precautions that have to be taken are to be found in published papers.*

5 SAFETY. For information on laboratory safety, refer to the relevant parts of AS 2243.

6 REAGENTS.

6.1 General. Unless otherwise specified, all reagents shall be of recognized analytical quality, and distilled or deionized water shall be used throughout.

* Studies in bomb calorimetry I-XI, *Fuel* (London), 33 (1954) to 38 (1959). British Coke Research Association, 'Determination of the calorific value of coke', Coke Research Report 9, Chesterfield, 1961, 12 pp.